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Reconceptualising the information system as a service

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A TEACHING CASE: TOWARDS BRIDGING DISCIPLINARY DIVIDES IN IT EDUCATION

Abstract

Information Technology (IT) now plays a central role in almost all aspects of business. However to best realise the potential of IT, it is vital that educators adopt strategies that challenge rather than reinforce existing disciplinary divides in IT education and business. This paper supports the application of active learning, via the use of a serial teaching case, towards bridging disciplinary divides in IT education. Specifically, the case calls for the design, development and implementation of an Integrated Management Information System. Students are therefore required to demonstrate analytical as well as technical skill-sets in the areas of IT, accounting and business. The paper describes the business context facing AHN Ltd. and illustrates the pedagogic use of the case as a means of integrating IT with aspects of accounting and business knowledge, towards helping educators contribute to answering the calls from academia (Panko, 2008) and industry (Chan and Reich, 2007) for graduates with a hybrid of business and IT skill-sets.

Keywords: Business Case, Active learning, Linkage, Knowledge.

1 INTRODUCTION

Active learning approaches, such as case-based learning and problem-solving, have been advocated as ways of fostering deeper learning (Boyce et al., 2001; Biggs, 1994). Organizations such as Microsoft and Financial Services have been using problem-solving scenarios such as simulations to both test and train employees. Use of such scenarios and role play will through real world problem-solving enhance the learner's logical reasoning, numeric abilities and spatial thinking. Realising the potential of such methods however requires active engagement from educators and learners alike (Baskerville, 2008; Healy and McCutcheon, 2008). For many educators willing to engage in such methods, the lack of appropriate materials and guidance is often perceived as a barrier. This paper presents one approach to active learning, via the use of the AHN Ltd. case study.

AHN Ltd. is a serial teaching case based on the ongoing analysis of AHN Ltd., a manufacturer of electronic toys. The case, described in the next section and discussed in section 3, is used as a fictional business scenario whereby students assume the role of an entity tendering for and then offering a prototype IT solution to meet the business needs of AHN Ltd. The materials are structured in a manner whereby a given instructor can focus on one particular aspect or disciplinary perspective (e.g. that of a programmer or of a management accountant); alternatively the case can be used more generally, to link IT to business, thereby mitigating the possibility of silos or islands of knowledge being created around the individual modules of a given programme of study. Use of the case also facilitates a key pedagogical component of any learning experience: that of real world problem-solving, where the problem is not phrased like a question from the textbook.

Problem-solving skills require the use of a number of different learning strategies and types of knowledge. The learner's own experience, internal mental models, and other 'cognitive structures' are necessary to 'construct' their own knowledge when faced with new information or different situations (Baskerville, 2008; Reeves, 1997). This case is organised to provide the student with a detailed description of the company. Attention is drawn to the inadequacies of the current IT infrastructure to enable students to identify and develop solutions to address these. The case has been successfully used on a module in a postgraduate programme in IT and Management Accounting. Used in total or in part the case illustrates and develops the practical as well as the theoretical alignment of business and IT. Individual lecturers can decide based on resource constraints and student capabilities to make elements we have included in the teaching note available to their students, for example Figure 1 or multiple components of Figure 2. Section 4 describes, in detail, the approach used to teaching the AHN Ltd. case.

2 THE TEACHING CASE: AHN LTD.

AHN Ltd. makes electronic toys. In recent years production and sales levels have grown rapidly and without corresponding attention being paid to the information systems (both financial and non-financial) within the organization. What was once a small operation now has a turnover of €35million and close to 100 employees. AHN Ltd wishes to embrace the philosophy of 'continuous improvement' throughout all its operations and administrative activities, stream-lining manufacturing processes, reducing costs and improving quality and customer satisfaction. A web presence is also under serious consideration.

There are three main product lines: 'Space Contender', 'Corporate' and 'Executive'. Details of the three products are as follows:

- *Space Contenders*

This a hand-held game device aimed primarily at the Christmas toy market; thus demand is seasonal, peaking in the months of September, October and November. The 'Space Contenders' line is a cost

leader in the marketplace and a replacement/substitute for a highly popular imported product. AHN Ltd. produces the product to stock, primarily to use up excess resources as they arise. The current sales price is €20 per unit.

- *Corporate*

This is an executive hand-held game device, consisting of a basic plastic console unit for which individual game modules can be purchased. Basic units are mass-produced, and then individually tailored to customer requirements. A key aspect is the customization of the accompanying gaming software. AHN Ltd. offers its customers the opportunity to incorporate their logos and promotional features into the games, providing them with an unusual and innovative means of advertising. Selling price is dependent on the quantity of an order and the amount of customization required. The 'Corporate' line is sold mainly, though not exclusively, through corporate advertising agencies to large multinational clients. Orders are large and demand is fairly constant throughout the year.

- *Executive*

The 'Executive' line is similar to the 'Corporate' model, but cheaper in price. Distribution is mainly through office supplies wholesalers.

The current manufacturing facility was purpose built to accommodate the initial products, 'Space Contender' and 'Corporate'. A state-of-the-art plastic moulding machine was installed to produce unit casings. Polymer resin compound is moved from the raw material storage area and delivered to the moulding machine, where it is processed into moulded casing units. A second moulding machine was purchased to facilitate production of 'Executive' casings. Finished casings are then stored until required for assembly. Production of finished units takes place along three modern assembly lines. The process of loading software onto each of the products is largely automated and currently operates at 60% capacity. Completed units are then sent to Quality Control for Inspection/Testing. Defective products are returned to the assembly area for re-processing. Checked and passed Finished Goods are placed in pre-printed boxes and stored for shipment. The entire warehouse area is fully racked and spacious, and complies with all current Health and Safety regulations.

2.1 Sales Activity

AHN Ltd. has three markets regions: Republic of Ireland, Northern Ireland and the U.K. Five full-time sales persons service this market. Each sales representative is provided with a company car and paid a basic salary, plus commission (calculated monthly), equal to 5% of gross sales revenue. AHN Ltd.'s total customer base of approximately 1,760 clients includes an estimated 310 dormant accounts. Sales Invoices number (on average) 1,100 per month.

Sales Orders are posted, phoned or faxed by customers or Sales Representatives to the Sales Support/Customer Services personnel. Orders received are written up manually on Sales Order/Dispatch Forms. These forms come in pre-printed books with four carbon copies. Original Sales Order/Dispatch Forms are passed (physically) four times daily, to the Production Director. Copy orders are passed to the Sales/Marketing Director, the Accounting Office and the final copy is retained in the Sales Order/Dispatch Form Book. The Production Director passes orders for in-stock finished goods items to the Credit Controller for Credit Checking. Sales Orders passed by the Credit Controller are then forwarded to Dispatch and given to warehouse personnel to use as a picking list. Filled orders are deposited in the Dispatch Area and warehouse personnel sign off the Sales Order/Dispatch Form. The Dispatch Clerk also signs off on the Form and makes two photocopies of it. The original is enclosed with the goods for delivery; one copy is placed on file in Dispatch and the other photocopy is passed to Accounting for entry into Invoicing on the accounting system. Invoices are batch processed and update takes place every evening. During update the system can be accessed

only for information purposes – no data can be entered or edited. Invoices are printed daily and posted to customers. Statements are printed at the end of every month and posted to customers. Sterling invoices however are typed separately and are currently not entered into the accounting system at all. At the end of each accounting period, sterling sales activity is accounted for via a series of journal entries to the monthly accounts.

Goods returned by customers are checked by the Store man and written up on a pre-printed (triplicate) Goods Returns/Credit Claim Form describing the reason for claim: typically breakages, rejected goods, wrong location. The original document is sent to the customer, one copy is kept in the Stores and the other copy is passed to Accounting for processing. Goods Returns/Credit Claim Forms are entered into the accounting at the end of each month before customer statements re printed and posted. During peak periods the paper trail can break down. Before further expansion can take place this shortcoming must be addressed.

2.2 Production Activity

Production scheduling is done on a weekly basis, using an excel spreadsheet, and is normally based on budgeted sales for the period. The Production Manager gives a (verbal) daily production report to the General Manager. Production output is also recorded on Output Sheets, which are filled in twice daily and used by the Store Man to maintain finished goods stocks in the accounting system. Invoicing updates automatically update finished goods stock levels. However the present system ignores items salvaged from damaged reworked product returns returned to finished goods stocks for re-sale.

AHN Ltd. deals with 149 suppliers. Where possible, raw materials are sourced locally. All transactions are conducted in Euros. Purchase Orders for raw materials are created manually using pre-printed Purchase Orders. AHN Ltd. generates an average of 180 purchase orders per month and issues approximately 162 cheques each month, although the organization does hope to implement paperless transactions within two years in compliance with Irish Payment Services Organization (IPSO) regulations. Authorized Purchase Orders are posted to suppliers, with a copy held by the Storeman for comparison purposes when goods are received. Typically however the Storeman signs for all goods received as being 'received unchecked' given the distance between his office and the goods inward section of the production facility. At the end of each shift, the Storeman uses the delivery dockets to enter the receipts of that day on the accounting system. He then forwards the delivery dockets to the Accounting office.

2.3 Existing Information Systems

AHN Ltd. is equipped with a dated Nixdorf computer system that currently runs linked Invoicing, Payroll, Accounts Receivable, Accounts Payable, and General Ledger on a group of four networked terminals. When the system is in 'end-of-period' mode, data cannot be entered or edited and system querying is limited and slow. It takes approximately four hours to run all the reports (assuming all goes well and the run is not accidentally interrupted); therefore the company does not generate reports on a weekly basis. Payments received from customers are manually recorded in the Cash Book on a daily basis and entered from the Cash Book onto the Nixdorf system at the end of each month prior to generation of end of month reports. Monthly customer account statements are printed, in duplicate, with the original posted to the customer and the copy kept on file in the Accounting office. A sales report is also generated at the end of each monthly accounting period, listing all invoices and credit notes printed from the system. However the system offers no facility to analyse this data. Recently an accounting intern used the printout to generate sales analysis reports (using Excel) of the profitability of major customers and of the total commission payments associated with these sales.

The R&D department is equipped with two powerful workstations used for computer-aided design (CAD) and word-processing. All other departments have stand-alone PCs using Microsoft packages.

AHN Ltd. finds the Microsoft products to be user friendly and is attracted to the free download of upgrades. Many of AHN' administrative personnel have successfully completed the EDCL course and the company is, therefore, favorably disposed to the use of Microsoft Access and VB.Net for the development of future computer systems.

2.4 The Need for Change: Invitation to Tender

AHN Ltd. wishes to up-date its existing system (along with the informal paper-based recording that has built up around it) and convert to a more modern, user friendly, flexible, open platform system. The company has issued an 'Invitation to Tender', inviting suitably qualified organizations to respond. Tenders are sought for the investigation, design, development and implementation of an Integrated Management Information System (hereafter referred to as an IMIS). The new system should be menu driven, be user friendly with an on-line help facility, and have security and control systems including password levels at Operating System Level and Application Level, to control user access and system audit trails. Live demonstration of a prototype of the proposed system will also be required of all those short-listed in the tendering process. Specifically, contracting organizations must:

- Prepare a full analysis of the requirements of the IMIS Project;
- Outline proposed software development, implementation and project management techniques;
- Submit a profile of proposed project team members and the role(s) they will play;
- Demonstrate an understanding of potential problems and risks involved;
- Attend regular meetings with AHN Ltd. personnel, providing progress reports and demonstrating work done on the prototype to date;
- Present a working prototype solution of their proposed system, including pro forma statements of all paper-based elements;
- Provide supporting documentation, including 'trouble shooting' advice and a users' manual.

3 DISCUSSION AND CONCLUSIONS

In recent years, research has increasingly advocated active learning strategies (Boyce et al., 2001; Biggs, 1994). Active learning strategies will initially challenge most students. However careful introduction can and does offer benefits even to those who were not originally technically oriented. Research on the use of cases as a teaching strategy indicates that the difficulties that can arise relate to the *application* of active learning methods, rather than with the method in and of itself (Healy and McCutcheon, 2008). Our experience of using the case presented in this paper demonstrates that such difficulties can be overcome, provided lecturers maintain a two-way communication flow with students. The emergent nature of the eventual case 'solution' must also be recognised from the outset and viewed as an opportunity for (rather than a constraint to) the on-going development of the eventual prototype solution.

One of the key advantages of the AHN Ltd case is its hybrid orientation towards IT and Business. This dual focus facilitates students in developing a broader range of competences and an increased understanding of two key dimensions of software development: the technical dimension concerned with *how to develop systems*; and the business relevance dimension concerned with *what features to develop*. In our use of the business case, staff from the disciplines of Management Accounting and Information Systems are equally involved and play the role of users whose requirements must be met by specific features of the software. The problem-solving approach offered via the AHN Ltd case also generates a multiplier effect which results in students demonstrating a much greater familiarity and expertise with the development platforms they use than the content of formal lectures and tutorial sessions provided to them would otherwise offer. Working on the case study also gives students the occasion to understand the need for hybrid IT-Business expertise. For example in the area of systems development methods, the difference between theoretical knowledge and practical understanding is readily visible, as students re-label existing methods and mix them together to suit the needs of the

project requirements. Some groups are attracted to rapid application development (RAD) type methods and claim to deliver quicker, cheaper software, while others swear allegiance to traditional systems development life cycle (SDLC) and play the *purity* game. The search for a 'single right answer' becomes forgotten as students focus on continuously improving their own solution to the problem posed in the case description. Additionally, for our students, this has led to greater confidence and greater likelihood of attracting potential employers in interview situations.

Classes are divided into teams (with all of the dynamics of a group of developers) and asked to form consultancy companies with the ultimate goal of winning a tender. The teams compete with one another to develop a system for a customer, AHN Ltd., which is represented by staff teaching on the degree programme utilizing the case to integrate business and IT topics. Therefore learners experience a broad range of tasks and problems inherent in commercial software development (Baskerville, 2008; Yang et al., 2008). The communication that must develop between the developers and their users of the AHN Ltd. prototype is quite realistic and reveals the gaps in understanding that can arise between individuals from different functional backgrounds. This aspect of the case gives students practical experience of the difficulties in discussing and presenting technical concepts to non-technical users. Students are forced to realize, acknowledge and understand the integration of materials taught in distinct stand-alone modules, often by staff from a number of disparate departments. Students are also encouraged to utilize their existing knowledge instead of waiting for the materials to 'come to them' as typically happens in a traditional lecture-based learning environment. The resulting skills-set developed through such activity meets the calls for same in both professional and academic sources (Panko, 2008; Chan and Reich, 2007). In conclusion, the AHN Ltd case described in this paper provides a useful vehicle for enabling lecturers to support students towards bridging disciplinary divides in IT education.

4 TEACHING APPROACH

The case study was designed to facilitate and support understanding and learning of the links between IT and its business applications. The company (AHN) description and tendering process presents students with an opportunity to play the role of practitioners tendering for the contract to develop an IMIS system. Topics covered through the AHN Ltd. teaching case include; analyzing IS requirements; developing the enterprise database; creating interfaces; designing reporting systems and project management. Table 1 outlines the how these topics can be taught and assessed through the AHN Ltd. case. The paragraphs that follow discuss how we have used the case in our own teaching.

At the start of the teaching period, the class is divided into teams of 4-6 members, depending on the size of the group. We ask for volunteer team leaders at the first class meeting; then once each class member has introduced themselves and summarized their academic background in terms of areas of prior studies, the team leaders take it in turns to select team members. Each group is expected to meet at least once a week. Project Teams are asked to record minutes of all meetings and these must be kept for review by the co-ordinators throughout the year (there may be little advance notice of reviews given). Microsoft Project is used to co-ordinate the work effort; thus planning of tasks and workloads well in advance will form an essential element of the overall assignment.

The case is structured to run as a series of workshops (see Table 2) to gradually build knowledge of the subject domains while simultaneously simulating 'real world' situations when the groups are asked to deliver a series of requirements to determine their level of understanding of the business case. At the end of each workshop the goals for the next workshop are set, based on the level of knowledge and understanding demonstrated by students up to that point. When presenting their deliverables at the beginning of each workshop it fast becomes evident if they do not fully understand the content delivered or required. This enables a post-mortem evaluation approach (Kasi et al., 2008). Workshops also provide an opportunity for students to evaluate each others work – in the past, we have

approached this by asking individual groups which aspects of each others systems they would most covet and which they would recommend making changes to. The pace of the work will determine the intervals required between workshops. Typically we hold workshops every three weeks, over the course of a 24-week teaching time.

Generative Topics	Programming, Accounting, Project management, Systems Analysis and Design, DB and VB.Net Development and Business communication.		
		Performances	Assessment
Through-lines	How to you address programming / business problems?	Students will understand how to programme	Related exercises
	How do you identify the IT/Acc requirements of a business?	Students will see the connection between IT and Accounting	Provide the requirements of a business case
	How should you address analysis requirements?	Students will understand how to analyze problems	Illustrate a logical view of a solution
	How can you use what you have learned to build a solution?	Students will understand the building blocks of a system	Provide code
	How do you use two disciplines like IT and Accounting to solve a business problem?	Students will address business and programming concerns	Provide a system based on user requirements
	How do you use business communication skills?	Students will understand the skills necessary to convey technical issues to mixed audiences	Feedback on presenting and reporting skills
Understanding	Goals	How to:	
	Students will understand the process of 'Forming fictitious companies'	Present Company structures, etc.	By peers and provided with feedback.
	Students will understand how to identify the requirements of a business and to apply a divide and conquer approach to a problem enabled through the provision of a 'Tender Document'	Develop Database structures & Entity-Relationship Diagrams Report Templates	Presentation of solution and Q & A session.
	Students will understand how to develop a Database with a VB.NET front-end	Present a walkthrough of the key elements of a working application	Presentation of solution, with detailed feedback provided
	Students will learn to tender for a winning contract and compete against their peers through the delivery of a 'Final Prototype'	Students will understand the complete process of developing a working system utilizing the skills learned from multiple disciplines	Construction and presentation of the final versions of solutions, to a panel of 'experts'

Table 1: Topics Taught Through the AHN Ltd Case

The final workshop serves as a showcase for the end result of the process (Table 2 – Industry Panel). As the lecturers co-ordinating the game, we do not participate in the discussion and evaluation process during this workshop. However, we ask some of our colleagues to attend this presentation, in lieu of the senior management members of AHN Ltd – thus simulating a real-world tendering process and enhancing the overall learning experience of the students. We also invite relevant professionals from industry to attend and evaluate the IMIS solutions. In all instances, this has served as both recognition of the student inputs throughout the learning process and as a showcase of student capabilities. The final presentation also brings closure to case and a sense of achievement to students and lecturers alike.

Content (what)	Methods (how)	Purposes (why)	Forms (communication)
<i>Workshop 1:</i> Group Dynamics Project Management	Identify the core issues in working & managing groups & in forming a consultancy firm.	To resolve group issues & identify the roles necessary to solve the problem at hand. To engender healthy competition between class groupings.	Groups record meetings using MS Project; actions are planned and communicated. Competition arises via the drive to meet the games requirements.
<i>Workshop 2:</i> Accounting principles	Apply principles of Accounting to the 'Forms' as required for the AHN Ltd study.	To understand the fundamentals of accounting. To be able to build a useful Accounting system.	Groups present their solutions to the accounting requirements during workshops & consider the programming translation through a user interface & code. Environmental considerations are also addressed through 'what if' scenarios are posed during Q&A sessions.
<i>Workshop 3:</i> IT Analysis & Development methods	Describe the processes outlined in a problem area & in aligning the proposed solution (Accounting & Programming).	To visualize a problem & determine the requirements of the users. The application & use of 'best practice' approaches for building a solution. To understand the integration of IT with the business context.	Groups document the requirements in both a report & through presentations. Each group's analysis is reviewed by instructors & their peers, offering suggestions for improvements.
<i>Workshop 4:</i> Designing accounting Reports	Describe the processes outlined in a problem area & in aligning the proposed solution.	To integrate the disciplinary areas & increase students' knowledge through the application of the material taught.	Templates are presented to the instructors who as the users of the game provide feedback.
<i>Workshop 5:</i> DB Development ERD Techniques	Construct & implement a feasible project plan Create & populate Data set	To use development knowledge in determining the relationships to the identified entities & building a solution. To test the types of relationships & data dictionaries defined.	Students present a series of proposed ERDs editing & updating their solutions as feedback is received from both peers & lecturers. DB are presented & documented with versions amended to the requirements of the different audiences.
<i>Workshop 6:</i> VB.NET programming Problem-solving	Differentiate between the possible problem-solving techniques & business solutions.	To apply a 'divide & conquer' approach to the problem. To understand the different applications of code (reusing code)	Solutions are presented & discussed. The testing process is also documented as well as 'what if' scenarios through error trapping.
<i>Workshop 7:</i> Demo of prototype 1.0	Develop working prototypes utilizing the following applications: Access 2003 & VB.NET.	To enable students to adopt a trial & error approach incorporating the end user in the development process.	Prototypes are presented & evaluated by end users emphasizing different functionalities to particular groups of users.
<i>Workshop 8:</i> Demo of prototype 2.0 Business communication: presenting, report writing.	Recommend & present a final solution to the business problem.	To simulate a real business scenario. To develop presenting & reporting skills. To understand & value of these skills	Present to internal as well as external representatives of the AHN company to meet the requirements of an audience with different backgrounds & roles within the fictitious company.
<i>Industry Panel</i> Presentation & Review	Groups presents final prototypes	To simulate a 'real-world' tendering process.	Present to practitioners (represented by industrial and academic practitioners).

Table 2: Workshop Structure

The IMIS consists of four sub-systems; Purchasing, Manufacturing, Inventory, and Sales/Ordering. Figures 1, 2 and 3 illustrate a sample solution. The focus in this instance is the Sales/Ordering (Figure 1). However this does not preclude selective inclusion of any or all of the other components. Lecturers are therefore enabled to select content which best matches with their overall teaching goals and student learning outcomes as well as the resource constraints of the learning context. Tables 1 and 2 illustrate the capabilities of the case as a pedagogic device - but allow individuals to also tailor their contents as appropriate. For example, different groups within the class could be assigned particular sub-systems to complete.

Table 3 provides a suggested grading structure totalling 200 marks (based on a module worth 10 ECT credits). Each Project Team is assessed not just on their final project submissions but also on performance over each stage and 'deliverable'. The emphasis is on the learning process throughout the duration of the exercise, feedback is always provided following each scheduled presentation (for post-mortem evaluation). Again, individual instructors can tailor this scheme (or abandon it totally) to meet their own requirements.

25% (50 marks)	Programming: VB.Net.
25% (50 marks)	Database development, DB structures and design issues.
25% (50 marks)	Accounting Issues.
12½% (25 marks)	Project Management.
12½ % (25 marks)	Overall Professionalism / presentation / etc.

Table 3: The Grading Structure

In conclusion, we have found the use of the AHN Ltd case to be an enriching, rewarding experience for all participants. Each year, we as co-ordinators learn something new from the process, as well as enabling our students to attain levels of understanding and appreciation for the underlying subject areas that have heretofore been difficult (if not impossible) to achieve in more traditional teaching contexts. Soft skills in terms of presenting, team-work, problem-solving and conflict resolution are embedded into the delivery of the case solution. The unanimous sense of satisfaction and achievement anecdotally reported by our students (despite the initial difficulties they encountered in the learning process) has convinced us of its power and capability to aptly serve as a means of bridging disciplinary divides in IT education.

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Figures

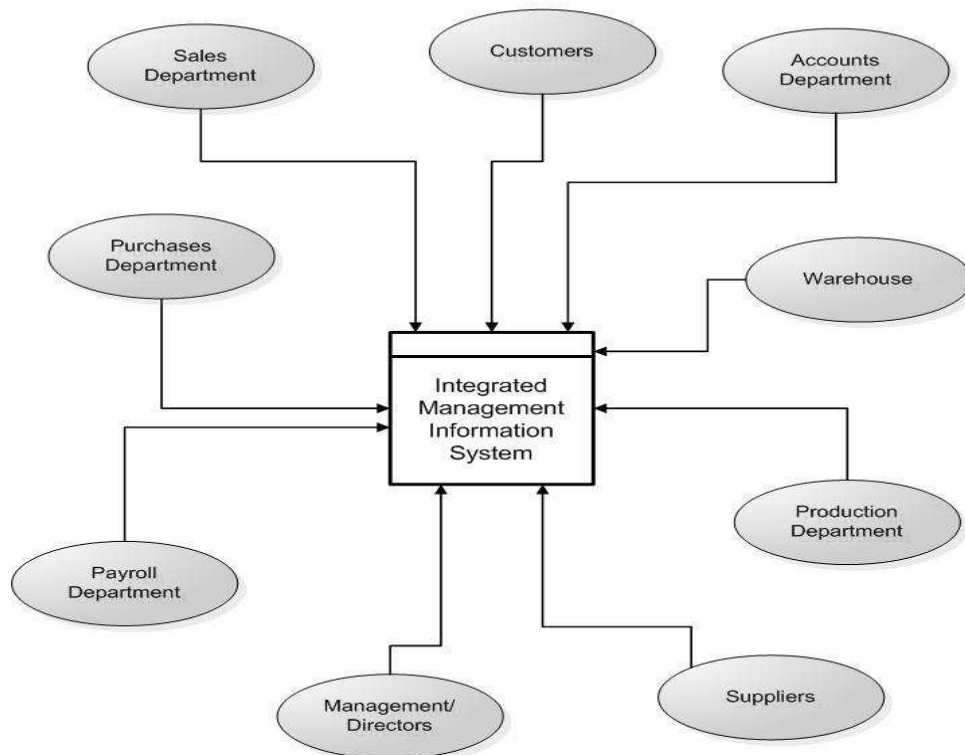


Figure 1: Proposed IMIS

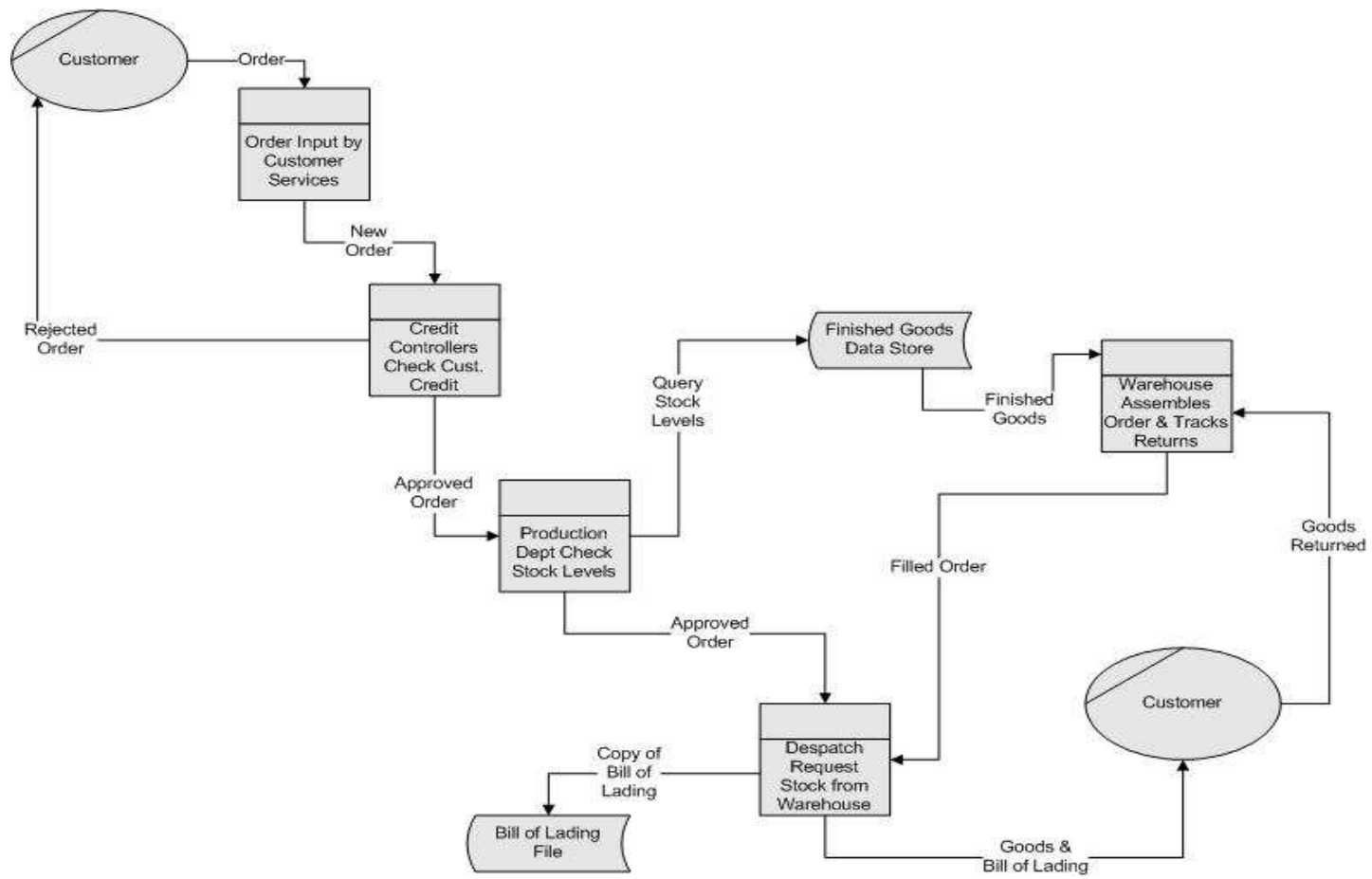


Figure 2: Sales/Order Process

